CLAIMS

THAT WHICH IS CLAIMED IS:

1. A burner module for delivering a flow of chemical reactants to a combustion site of a chemical vapor deposition process, said burner module comprising:

a) a plurality of substantially planar layers arranged in a generally parallel and fixed relationship and defining an inlet, an outlet and a passage fluidly connecting said inlet and said outlet, at least one of said layers being a distribution layer having a plurality of apertures therethrough and fluidly communicating with said passage;

b) wherein said plurality of apertures collectively define a non-uniform pattern arranged and configured to improve the uniformity of a flow out through said outlet.

2. The burner module of Claim 1 wherein said apertures have non-uniform sizes.

3. The burner module of Claim 1 wherein each of said apertures has a diameter of between about 5 and 300 microns.

4. The burner module of Claim 3 wherein each of said apertures has a diameter of between about 50 and 200 microns.

5. The burner module of Claim 1 wherein said apertures are micromachined through said distribution layer.

6. The burner module of Claim 1 including an outermost burner face layer and wherein said outlet is formed in said burner face layer.

7. The burner module of Claim 6 wherein said outlet has a diameter of between about 100 and 2000 microns.

8. The burner module of Claim 7 wherein said outlet has a diameter of between about 300 and 1000 microns.

9. The burner module of Claim 6 wherein said outlet has a diameter greater than the diameters of each of said apertures.

10. The burner module of Claim 1 including a second distribution layer between said first distribution layer and said inlet, said second distribution layer having a plurality of second apertures therethrough and fluidly communicating with said passage, wherein the average diameter of said apertures of said first distribution layer is less than the average diameter of said second apertures.

11. The burner module of Claim 1 wherein at least a portion of said layers is formed of a material selected from the group consisting of glass, silicon, silicon carbide, borosilicate glass, polycrystalline silica, ceramic, plastic and photodefinable metal.

12. The burner module of Claim 1 including:

a second inlet;

a second outlet;

a second passage fluidly connecting said second inlet and said second outlet; and

a plurality of second apertures formed in said at least one of said layers and fluidly communicating with said second passage;

wherein said plurality of second apertures collectively define a second non-uniform pattern arranged and configured to improve the uniformity of a flow out through said second outlet.

13. The burner module of Claim 12 wherein said first non-uniform pattern is different from said second non-uniform pattern.

14. The burner module of Claim 13 wherein said first and second passages do not fluidly intersect with one another.

15. The burner module of Claim 1 comprising:

a) a substantially planar lower plenum layer having first and second slots formed therein;

b) a substantially planar upper plenum layer having first and second slots formed therein;

c) a burner face layer overlying said upper plenum layer, said burner face layer including at least first and second burner apertures fluidly communicating with said first and second slots of said upper plenum layer, respectively;

d) wherein said distribution layer is interposed between said upper and lower plenum layers and includes:

a plurality of first apertures formed therein and fluidly communicating with said first slots of said upper and lower plenum layers, wherein said plurality of first apertures collectively define a first non-uniform pattern; and

a plurality of second apertures formed therein and fluidly communicating with said second slots of said upper and lower plenum layers, wherein said plurality of second apertures collectively define a second non-uniform pattern; and

e) wherein said first and second non-uniform patterns are arranged and configured to improve the uniformity of a flow through said lower plenum layer, said distribution layer and said upper plenum layer and out through said first and second burner apertures.

16. The burner module of Claim 15 including a second distribution layer underlying said lower plenum layer, said second distribution layer including:

a plurality of third apertures formed therein and fluidly communicating with said first slot of said lower plenum layer, wherein said plurality of third apertures collectively define a third non-uniform pattern; and

a plurality of fourth apertures formed therein and fluidly communicating with said second slot of said lower plenum layer, wherein said plurality of fourth apertures collectively define a fourth non-uniform pattern.

17. The burner module of Claim 16 wherein said third and fourth non-uniform patterns are different from said first and second non-uniform patterns.

18. The burner module of Claim 15 wherein said first and second burner apertures each have a diameter of between about 100 and 2000 microns.

19. The burner module of Claim 15 wherein said first and second slots of said upper plenum layer each have a width of between about 650 and 1000 microns.

20. The burner module of Claim 15 wherein the distance between said first and second slots of said upper plenum layer is between about 100 and 1000 microns.

21. The burner module of Claim 20 wherein the distance between said first and second slots of said upper plenum layer is between about 350 and 500 microns.

22. The burner module of Claim 15 wherein each of said lower plenum layer and said upper plenum layer has a thickness of between about 1 and 5 mm.

23. The burner module of Claim 22 wherein each of said lower plenum layer and said upper plenum layer has a thickness of between about 2 and 4 mm.

24. The burner module of Claim 15 wherein said distribution layer has a thickness of between about 300 and 700 microns.

25. The burner module of Claim 24 wherein said distribution layer has a thickness of between about 400 and 550 microns.

26. The burner module of Claim 15 wherein each of said lower plenum layer, said distribution layer, said upper plenum layer and said burner face layer is formed of a material selected from the group consisting of glass, silicon, silicon carbide, borosilicate glass, polycrystalline silica, ceramic, plastic and photodefinable metal.

27. A burner mounting adapter for use with a manifold having a mount surface and first and second fluid supply openings in the mount surface and distributed at different locations along a length of the manifold, said burner mounting adapter comprising:

a) an adapter body;

b) a first inlet aperture, a first outlet aperture and a first connecting passage fluidly connecting said first inlet and outlet apertures defined in said adapter body; and

c) a second inlet aperture, a second outlet aperture and a second connecting passage fluidly connecting said second inlet and outlet apertures defined in said adapter body;

d) wherein said first and second inlet apertures are arranged and configured to align with the first and second fluid supply openings, respectively, when said burner mounting adapter is mounted on the mount surface of the manifold; and

e) wherein said first and second passages extend transversely of the manifold length when said burner mounting adapter is mounted on the mount surface of the manifold.

28. The burner mounting adapter of Claim 27 wherein said adapter body includes a plurality of substantially planar layers arranged in a generally parallel and fixed relationship.

29. The burner mounting adapter of Claim 27 wherein the transverse distance between said first and second outlet apertures is less than the transverse distance between said first and second inlet apertures.

30. The burner mounting adapter of Claim 27 wherein said first and second passages do not fluidly intersect with one another.

31. The burner mounting adapter of Claim 27 including an integral mounting portion disposed transversely outwardly from said first and second outlet apertures.

32. The burner mounting adapter of Claim 31 including a mounting hole in said mounting portion.

33. The burner mounting adapter of Claim 27 including:

a) a substantially planar lower adapter layer having said first and second inlet apertures formed therein;

b) a substantially planar intermediate adapter layer having first and second slots formed therethrough, wherein:

each of said first and second slots extends transversely of the manifold length from a first end to a second end;

said first inlet aperture is disposed adjacent and in fluid communication with said first end of said first slot; and

said second inlet aperture is disposed adjacent and in fluid communication with said first end of said second slot; and

c) a substantially planar upper adapter layer overlying said intermediate adapter layer and including said first and second outlet apertures formed therein, wherein:

said first outlet aperture is disposed adjacent and in fluid communication with said second end of said first slot; and

said second outlet aperture is disposed adjacent and in fluid communication with said second end of said second slot.

34. The burner mounting adapter of Claim 33 wherein said lower adapter layer, said intermediate adapter layer and said upper adapter layer are each formed from a material selected from the group consisting of glass, silicon, silicon carbide, borosilicate glass, polycrystalline silica, ceramic, plastic and photodefinable metal.

35. A burner module for use with a manifold having a mount surface and first and second fluid supply openings in the mount surface and distributed at different locations along a length of the manifold, said burner module comprising:

a) a burner mounting adapter including:

1) an adapter body;

2) a first inlet aperture, a first outlet aperture and a first connecting passage fluidly connecting said first inlet and outlet apertures defined in said adapter body; and

3) a second inlet aperture, a second outlet aperture and a second connecting passage fluidly connecting said second inlet and outlet apertures defined in said adapter body;

4) wherein said first and second inlet apertures are arranged and configured to align with the first and second fluid supply openings, respectively, when said burner mounting adapter is mounted on the mount surface of the manifold; and

5) wherein said first and second passages extend transversely of the manifold length when said burner mounting adapter is mounted on the mount surface of the manifold; and

b) a burner face layer overlying said adapter body, said burner face layer including at least first and second burner apertures fluidly communicating with said first and second outlet apertures of said adapter body, respectively.

36. The burner module of Claim 35 wherein said burner apertures each have a diameter of between about 100 and 2000 microns.

37. The burner module of Claim 36 wherein said burner module provides a back pressure in at least one of said first and second inlet apertures of no more than 25 psi when process gases are flowed through said burner module and exit through said burner apertures at a flow rate of 40 slpm of O_2.

38. The burner module of Claim 35 wherein said burner mounting adapter includes an integral mounting portion extending transversely beyond said first and second burner apertures.

39. The burner module of Claim 38 including a mounting hole in said mounting portion.

40. The burner module of Claim 35 wherein said burner mounting adapter includes:

a) a substantially planar lower adapter layer having said first and second inlet apertures formed therein;

b) a substantially planar intermediate adapter layer having first and second slots formed therethrough, wherein:

each of said first and second slots extends transversely of the manifold length from a first end to a second end;

said first inlet aperture is disposed adjacent and in fluid communication with said first end of said first slot; and

said second inlet aperture is disposed adjacent and in fluid communication with said first end of said second slot; and

c) a substantially planar upper adapter layer overlying said intermediate adapter layer and including said first and second outlet apertures formed therein, wherein:

said first outlet aperture is disposed adjacent and in fluid communication with said second end of said first slot; and

said second outlet aperture is disposed adjacent and in fluid communication with said second end of said second slot.

41. The burner module of Claim 40 further including a flow conditioning assembly, said flow conditioning assembly comprising:

a) a substantially planar plenum layer interposed between said upper adapter layer and said burner face layer, said lower plenum layer having first and second slots formed therein and fluidly communicating with said first and second outlet apertures, respectively; and

b) a substantially planar distribution layer interposed between said upper adapter layer and said burner face layer, said distribution layer including:

a plurality of first apertures formed therein and fluidly communicating with said first slot of said plenum layer and with said first slot of said intermediate adapter layer; and

a plurality of second apertures formed therein and fluidly communicating with said second slot of said plenum layer and with said second slot of said intermediate adapter layer.

42. A burner assembly for delivering a flow of chemical reactants to a combustion site of a chemical vapor deposition process, said burner assembly comprising:

a) a manifold including:

1) a mount surface; and

2) first and second fluid supply openings in said mount surface and distributed at different locations along a length of said manifold;

b) a burner module comprising:

1) a burner mounting adapter including:

i) an adapter body:

ii) a first inlet aperture, a first outlet aperture and a first connecting passage fluidly connecting said first inlet and outlet apertures defined in said adapter body; and

iii) a second inlet aperture, a second outlet aperture and a second connecting passage fluidly connecting said second inlet and outlet apertures defined in said adapter body;

iv) wherein said first and second inlet apertures are arranged and configured to align with the first and second fluid supply openings, respectively, when said burner mounting adapter is mounted on the mount surface of the manifold; and

v) wherein said first and second passages extend transversely of the manifold length when said burner mounting adapter is mounted on the mount surface of the manifold; and

2) a burner face layer overlying said adapter body, said burner face layer including at least first and second burner apertures fluidly communicating with said first and second outlet apertures of said adapter body, respectively.

43. The burner assembly of Claim 42 including a first fluid supply fluidly connected to said first fluid supply opening through said manifold and a second fluid supply fluidly connected to said second fluid supply opening through said manifold.

44. The burner assembly of Claim 43 wherein said first and second fluid supplies are selected from the group consisting of O_2, N_2, CH_4, H_2, CO, $SiCl_4$, $GeCl_4$, OMCTS, CF_4, SF_6, SiF_4, $POCl_3$, ER(FOD), $AlCl_3$, and TICS.

45. The burner assembly of Claim 42 wherein said burner apertures each have a diameter of between about 100 and 2000 microns.

46. The burner assembly of Claim 45 wherein said burner apertures each have a diameter of between about 300 and 1000 microns.

47. The burner assembly of Claim 42 wherein said burner module provides a back pressure in at least one said first and second inlet apertures of no more than 25 psi when process gases are flowed through the burner module and exit through the burner apertures at a flow rate of 40 slpm of O_2.

48. The burner assembly of Claim 42 wherein:

said manifold includes a plurality of sets of fluid supply openings in said mount surface and distributed at different locations along said length of said manifold; and

said burner assembly includes a plurality of said burner modules each mounted along said length of said manifold over a respective one of said sets of fluid supply openings.

49. A burner module for delivering a flow of chemical reactants to a combustion site of a chemical vapor deposition process, said burner module comprising:

a) a burner face layer; and

b) a reflective layer covering said burner face layer.

50. The burner module of Claim 49 wherein said reflective layer is a thermally deposited oxide layer.

51. The burner module of Claim 49 wherein said reflective layer is a metal layer.

52. The burner module of Claim 51 wherein said reflective layer is a evaporatively deposited gold layer.